

Appl. No. 09/933,053

Amndt. dated January 19, 2004

Reply to Office action of November 19, 2003

REMARKS/ARGUMENTS

Reconsideration of the application is requested.

Claims 1 and 3-16 remain in the application. Claims 1, 3, 13, and 15 have been amended. Claim 2 has been canceled.

In the second paragraph on page 2 of the above-identified Office action, claims 1, 4-13 and 15 have been rejected as being unpatentable over Kramer et al. (U.S. Patent No. 5,080,056) in view of Sailer et al. (U.S. Patent No. 5,644,828) and Hammeke (U.S. Patent No. 4,724,299) under 35 U.S.C. § 103. In the second full paragraph on page 4 of the Office action, claims 2 and 3 have been rejected as being unpatentable over Kramer et al., in view of Sailer et al. and Hammeke and further in view of Pfeffinger et al. (U.S. Patent No. 6,221,504 B1) under 35 U.S.C. § 103.

The rejection has been noted and the claims have been amended in an effort to even more clearly define the invention of the instant application. Amended claim 1 includes the limitations of original claims 1 and 2. Support for the changes is found on page 8, lines 10-14 of the specification.

Before discussing the prior art in detail, it is believed that a brief review of the invention as claimed, would be helpful.

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Amended claim 1 defines a process for producing a wear-resistant, tribological cylinder bearing surface (16) for a piston (41) running in a cylinder (20) of a crankcase (40) of an internal-combustion engine, the process includes the steps of:

- positioning a laser (10) such that a longitudinal axis (26) of the laser (10) is substantially coaxial to a cylinder (20) of a crankcase (40) of an internal-combustion engine;
- rotating the laser (10) about the longitudinal axis (26) of the laser (10) and simultaneously advancing the laser (10) in a direction of the longitudinal axis (26) of the laser (10);
- feeding a powdery material through the laser (10) and directing a jet (13) of the powdery material to a cylinder bearing surface (16) of the cylinder;
- deflecting a laser beam (22) to an impact region (14) where the jet (13) of the powdery material impinges on the cylinder bearing surface (16) and guiding the jet (13) of the powdery material such that at least part of the jet (13) of the powdery material passes through the laser beam (22);
- at least partially melting, with the laser beam (22), a surface of the impact region (14) such that the surface of the impact region (14) is at least partially melted before

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the powdery material impinges on the surface of the impact region; and

- forming given structures in the cylinder bearing surface by using an additional laser treatment.

In the third paragraph on page 2 of the Office action, the Examiner correctly stated that Kramer teaches coating the interior walls of cylinder bores by thermal spraying.

However, Kramer does not teach the use of a laser.

More specifically, Kramer does not disclose the steps of:

- positioning a laser such that a longitudinal axis of the laser is substantially coaxial to a cylinder of a crankcase of an internal-combustion engine;
- rotating a laser about the longitudinal axis of the laser and simultaneously advancing the laser in a direction of the longitudinal axis of the laser;
- feeding a powdery material through the laser;
- deflecting a laser beam to an impact region where the jet of the powdery material impinges on the cylinder bearing surface and guiding the jet of the powdery material such that at least part of the jet of the powdery material passes through the laser beam;
- at least partially melting, with a laser beam, a surface of the impact region such that the surface of the impact region

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is at least partially melted before the powdery material impinges on the surface of the impact region; and

- forming given structures in the cylinder bearing surface by using an additional laser treatment, as recited in amended claim 1 of the instant application.

In the fourth paragraph on page 2 on the Office action, the Examiner stated that Sailer teaches that plasma spraying, arc spraying and laser spraying are all equivalent forms of thermal spraying. The Examiner seems to refer to the general statement in column 6, lines 19-23 of the patent to Sailer. It is noted that claim 1 does not encompass laser spraying as a general concept. Rather, claim 1 includes specific limitations on how the laser is positioned, how the laser is moved and how the beam of the laser is directed. None of these specific limitations of claim 1 is taught by Sailer.

More specifically, Sailer does not teach the steps of:

- positioning a laser such that a longitudinal axis of the laser is substantially coaxial to a cylinder of a crankcase of an internal-combustion engine;
- rotating a laser about the longitudinal axis of the laser and simultaneously advancing the laser in a direction of the longitudinal axis of the laser;

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- feeding a powdery material through the laser and directing a jet of the powdery material to a cylinder bearing surface of the cylinder;
- deflecting a laser beam to an impact region where the jet of the powdery material impinges on the cylinder bearing surface and guiding the jet of the powdery material such that at least part of the jet of the powdery material passes through the laser beam;
- at least partially melting, with a laser beam, a surface of the impact region, as recited in claim 1 of the instant application; and
- forming given structures in a cylinder bearing surface by using an additional laser treatment.

With regard to the Examiner's statement that it would have been obvious to utilize laser spraying as a method of thermal spraying in Kramer because Sailer teaches that plasma spraying and laser spraying are equivalent, it is noted that Sailer is concerned with repairing printing press cylinders. It is believed that a person of skill in the art, when faced with the object of producing a wear-resistant cylinder bearing surface for an internal combustion engine, would not be motivated to position the laser axis coaxial with the cylinder axis, rotate the laser and advance the laser together with a powder feed device because the laser beam might just as well

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be guided from the laser to the impact region by using a beam guiding device.

On page 3, lines 1-2 of the Office action, the Examiner correctly stated that Sailer fails to teach how a method of laser spraying is performed. The Examiner therefore cited the patent to Hammeke in order to show how a powdery material is fed through a laser in order to assure a uniform cladding of metal articles.

It is noted that the method of Hammeke is quite different from the method of the present invention. More specifically, Hammeke does not disclose the steps of positioning a laser coaxial to a cylinder, rotating and simultaneously advancing the laser, deflecting the laser beam to an impact region, and forming structures in the cylinder bearing surface by using an additional laser treatment, as defined in amended claim 1 of the instant application.

The laser spray nozzle assembly of Hammeke is a stationary device wherein only the body B can be adjusted in the axial direction. The laser spray nozzle assembly of Hammeke has horizontal coolant inlet pipes 56, 66 and horizontal coolant outlet pipes 60, 68 as well as a horizontal powder supply pipe 46 and a horizontal gas feed line 101. These horizontal lines

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are a clear indication that the laser source of the laser spray nozzle assembly is not configured to rotate. The patent to Hammeke only mentions that the nozzle body B of the laser spray nozzle assembly can be adjusted axially. Hammeke does not teach advancing the laser source along the axial direction and simultaneously rotating the laser source. Hammeke teaches moving the workpiece W relative to the laser nozzle (col. 6, lines 32-34). In contrast, claim 1 of the present application teaches rotating the laser and simultaneously advancing the laser along the workpiece.

In the paragraph bridging pages 3 and 4, the Examiner stated that one of ordinary skill would recognize that when using laser spraying in the device of Kramer, the laser must follow the same path as path as the sprayer. Clearly, moving the laser on the same path as the sprayer is only one of many possible embodiments. A person of skill in the art might conclude that the laser could just as well remain stationary and the laser beam could be guided to the impact region by using a beam guiding device. In view of Hammeke, a person of skill in the art might conclude that using a stationary laser would be simpler than using a rotating and advancing laser because it might be easier to guide the laser beam rather than move the laser itself. Thus a person of skill in the art would not necessarily conclude that the laser must follow the

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same path as the sprayer. Rather, moving the laser and the sprayer in synchronism is only one of many possibilities. However, when a limitation of a claim is one of several possibilities of combining elements of the prior art, the claimed invention is not rendered obvious by the prior art. More specifically, a combination of Kramer and Hammeke does not suggest that a laser should rotate and advance when the laser beam could just as well be guided from the laser to the impact region by using a beam guide as an alternative.

In order to show the limitation of forming given structures in the cylinder bearing surface by using an additional laser treatment, as recited in amended claim 1, the Examiner cited the patent to Pfeffinger et al. In the third full paragraph on page 4 of the Office action, the Examiner stated that "Pfeffinger teaches that additional laser treatments may be used to deposit lubricants into the interior walls of cylinder bores." The Examiner believes that the additional laser treatments are disclosed in col. 3, lines 35-40 and in the abstract of the patent to Pfeffinger.

In contrast to the Examiner's statement, Pfeffinger does not disclose a laser treatment. Col. 3, lines 35-40 only disclose adding hard metal, ceramic particles or dry lubricants to the spraying powders used for the thermal spraying. It is noted

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that Pfeffinger does not mention any laser treatment.

Pfeffinger mentions plasma spraying, in which particles are fed through an electric arc plasma, and flame spraying, in which powders are fed into an acetylene-oxygen flame (see col. 2, lines 11-14 and 21-22). Any teaching or suggestion about laser treatments that is allegedly disclosed in the patent to Pfeffinger is believed to be based on hindsight in view of the invention of the instant application. Thus none of the cited prior art shows or suggests an additional laser treatment for forming structures in a cylinder bearing surface, as recited in amended claim 1 or correspondingly in amended claims 13 and 15.

In the paragraph bridging pages 5 and 6 of the Office action, the Examiner argued that it would have been obvious to use a laser as the thermal means in the device of Kramer and that one of ordinary skill in the art would retain the movement already taught by Kramer. As stated above Hammeke only teaches a stationary laser apparatus. There is no suggestion in the prior art that a movable unit including a laser and a powder feed device and additionally a beam-deflecting device should be used in the coating device of Kramer. A person of skill in the art might just as well have used a stationary laser and might have guided the laser beam from the stationary laser to the impact region by using beam guiding devices.

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In the last paragraph on page 6 of the Office action, the Examiner stated that reliance on a large number of references in a rejection does not, without more, weigh against the obviousness of the claimed invention. It is correct that the criterion for nonobviousness is not the number of references, but what they disclose to a person of skill in art. In the present case the prior art references generally show various methods of plasma spraying, flame spraying and laser spraying. However, when it is necessary to select elements of various teachings in order to form the claimed invention, it must be ascertained whether there is any suggestion or motivation in the prior art to make the selection made by the applicant. As explained before, the prior art does not suggest the specific combination of limitations as defined in the claims of the instant application even when the teachings of Kramer, Sailer, Hammeke, and Pfeffinger are combined.

Applicants believe that the prior art does not provide any suggestion or motivation to combine the limitations as defined in claims 1, 13 and 15 and certainly there is no "clear and particular" teaching or suggestion in Sailer or Hammeke to incorporate the features of a rotating and simultaneously advancing laser as well a beam-deflecting device in the coating device of Kramer. Also, none of the cited prior art

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documents discloses an additional laser treatment in order to form structures in the cylinder bearing surface.

Neither Kramer nor Sailer nor Hammeke can suggest that the powder feed device and the laser should move together as a movable unit. Hammeke only teaches a powder feed through a stationary laser apparatus. There is no suggestion in the prior art that a movable unit including a laser and a powder feed device and additionally a beam-deflecting device should be used in the coating device of Kramer. The only teaching that the prior art can provide is the general statement in col. 6, lines 20-23 of Sailer, that simply lists a number of coating methods which may be used as alternatives. Only in hindsight is it possible to argue that the prior art suggests providing a beam-deflecting device and a powder feed device that is movable together with a rotating and simultaneously advancing laser in the device of Kramer, especially because the laser assembly of Hammeke does not rotate or advance axially and because the laser beam might be guided from a stationary laser to an impact region by using beam guiding means.

Further, none of the prior art documents can suggest the step of deflecting a laser beam or a beam-deflecting device. The Examiner argues that providing a beam-deflecting device would

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have been obvious in view of Fig. 2 of Kramer which shows that a spray 14 of alloy is applied to the cylinder wall 12. Again, it is believed that only in hindsight is it possible to argue that emitting a spray 14 of alloy through a radial hole in a coating head 17 would suggest providing a laser beam-deflecting device.

In summary, the combination of method steps in claim 1 and the corresponding structural limitations in claims 13 and 15 are not made obvious by a combination of Kramer, Sailer, Hammeke and Pfeffinger. It is accordingly believed to be clear that none of the references, whether taken alone or in any combination, either show or suggest the features of amended claims 1, 13, or 15. Claims 1, 13, and 15 are, therefore, believed to be patentable over the art and since all of the dependent claims are ultimately dependent on claim 1, 13, or 15, they are believed to be patentable as well.

Applicant respectfully requests that a timely Notice of Allowance be issued in this case.

In the event the Examiner should still find any of the claims to be unpatentable, he is respectfully requested to telephone counsel so that, if possible, patentable language can be worked out. In the alternative, the entry of the amendment is

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requested as it is believed to place the application in better condition for appeal, without requiring extension of the field of search.

Please charge any fees which might be due with respect to Sections 1.16 and 1.17 to the Deposit Account of Lerner and Greenberg, P.A., No. 12-1099.

Respectfully submitted,

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January 19, 2004

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